In the Specification:

Page 1, lines 1-4:

~~C739-01AW~~

Title: Improved grinding wheel spindle

~~Invention~~ Field of the Invention

This invention concerns grinding wheel spindles.

~~Background~~ Background of the Invention

Page 1, line 15 – page 2, line 2:

A number of issues are faced when designing grinding wheel spindles for this task:

1. Due to the small grinding wheel diameter, the spindle speed has to be proportionally higher to maintain a satisfactory wheel surface speed; and

2. The grinding wheel must be capable of reaching the base circle diameter of each cam lobe, and in particular a cam lobe at the end of a camshaft remote from the spindle housing, while allowing the tips of other lobes to rotate clear of the spindle body whilst it is situated parallel to the camshaft. Therefore the spindle shaft is restricted in diameter to allow this clearance.

It is therefore necessary for the rotating shaft to be long, to be of small diameter, and to be able to run at high rotational speeds.

Page 3, lines 11-15:

According to a preferred aspect of the invention the axial length of the rotor-bearing part of the shaft is shorter than the external part of the shaft, and the shaft is constructed so that the stiffness and the support of the shorter part of the shaft situated between the second and third bearings dictate that the bending resonance of the longer external part is above the critical spindle rotational frequency.

Page 4, lines 1-3:

then adjusted radially to bring all three bores into alignment.

Page 4, line 13:

~~Using a symmetrical design of housing for the motor assists~~

Page 4, lines 21-25:

In use, oil is supplied under pressure ~~hydrostatic~~ to the bearings by a pump which draws oil from a reservoir to which oil returns from the bearings the oil becomes heated in each bearing and the heated oil drains into lower regions of the enclosure formed by the rigid elongate shaft casing and the motor housing. As a result the lower regions of the enclosure can become heated in use to a higher temperature then the upper regions thereof.

Page 5, lines 3-11:

In order to overcome the potential for distortion due to a hot zone being created in the lower regions of the spindle housing, the lower regions of the enclosure are preferably formed as a separate oil collection box which is mounted to the remainder of the enclosure in such a manner that it will not impart a strain on the spindle shaft.

In order to reduce the transfer of heat to the bearings and upper regions of the enclosure, a thermal barrier may be provided between the said lower regions and the remainder of the enclosure to reduce the transfer of heat from the hot oil to the upper regions of the enclosure and thereby prevent thermally induced misalignment of the three bearings and any strain on the spindle shaft caused by any such misalignment.

Page 7, line 12 – page 8, line 5:

Fig 3 shows the drive motor housing 38 which is larger in diameter than the spindle housing 36. This demonstrates that the spindle needs to extend axially to the left of the drive motor housing 38 by a least the axial length of the camshaft 37~~40~~, so that the housing 38 will not interfere with the rotating cams. The spindle shaft 27 therefore has to be much longer than the case where the wheel diameter is significantly greater than that of the spindle housing 36 and drive motor housing 38. (It will be appreciated that where a larger diameter wheel is involved the shaft 27 need only

protrude from the drive motor housing 38 by a sufficient length to allow the wheel to be mounted thereon). Since the spindle shaft 27 now needs to be as long as the workpiece 3740, and the spindle and shaft are constrained in diameter for the reasons given above, the invention proposes the use of the third bearing as shown in Fig 4, so as to stiffen the shaft.

In Fig 4 the rotor 40 can be seen mounted on, or formed integrally with, part of the spindle shaft 27 and the small diameter grinding wheel 26 is shown mounted on the extreme left hand (outboard) end of the shaft. The latter is supported by three hydrostatic bearings 44,46,48. The bearings 44 and 46 are located at opposite ends of the rotor 40 and, with bearing 46 at the inner end 39 of the part 41 of the shaft 27 which is external to the motor housing. The the outer race of bearing 44 is mounted within the right hand end of the housing 38 which houses the stator (not shown) see Figure 5) of the motor.

The bearing 48 is located adjacent to the grinding wheel while bearings 44 and 46 are positioned either side of the rotor 40.

The outer race of bearing 48 is secured within the spindle body housing 36 while the outer race of bearing 46 is located at the interface between the spindle body housing 36 and the motor housing 38, and also forms the location reference between the two.

During manufacture two of the bearings are first aligned, and then the third bearing is adjusted radially so as to accurately align with the other two bearings, so that the shaft 27 runs true.

To facilitate a comparison of Figs 3 and 4 the housings 36, 38 are shown in dotted outline in Fig 4.